

## Voluntary Movement, Biofeedback Control and PK

*The focus of my interest in the paranormal has always been its implications for the mind-body problem. According to the conventional standpoint, the only physical effects we can produce are those we exert on our own bodies as mediated through the voluntary nervous system. An exception might have to be made to allow for the ancient technique of yoga whereby an adept could acquire control over various physiological processes normally regarded as outside voluntary effort. Recently the technique of biofeedback has demonstrated that anyone can gain control over their autonomic nervous system by this means without resorting to the arduous discipline of yoga. Whether a psi factor is or is not involved in such biofeedback control is open to question but at least it offers an intermediate category between normal motor activity and a genuine PK performance.*

*Once again it was the Parapsychology Foundation that provided me with a forum when they invited me to participate in a conference on "Brain/Mind and Parapsychology" (Parapsychology Foundation 1979) in Montreal in August 1978. As was customary at their conferences, the occasion brought together leading figures of the parapsychology community with eminent scientists and scholars who had made their names in other fields. The former category here include such familiar names as Charles Honorton, Charles Tart and Edward Kelly, the latter include Thomas Budzynski (an authority on biofeedback), Norman Dixon (the authority on subliminal perception), Jan Ehrenwald and Karl Pribram.*

The question I want to raise in this paper is the following: Is the power which enables us to influence the target system in a PK experiment the same power, basically, as that which we deploy every time we voluntarily move our limbs (using the word "power" in its most general and noncommittal sense)?

Or, in other words, can PK be regarded as the extrasomatic (and hence paranormal) extension of what, in ordinary volitional activity, is endosomatic (and hence normal)? The question was first explicitly raised, I believe, by Thouless and Wiesner (1947) in their classic paper, where they also put forward the idea that ESP is the extrasomatic extension of what occurs in normal perception and cognition where the mind extracts information from the brain to create a meaningful conscious percept or thought. Here, however, we shall be concerned exclusively with the problem of PK. If the answer to this question is no, if the Thouless-Wiesner thesis is mistaken, then, presumably, PK represents some special power or faculty that is *sui generis* and radically different from anything else that forms part of our ordinary mental life. The question is, I consider, worth raising again both because of the light it may throw on the nature of PK and because of its implications for the mind-body problem.

At first it may seem that there is little to commend the analogy. In the first place, whereas voluntary movement is a universal fact of life, PK is an exceedingly rare and dubious phenomenon, at any rate insofar as it can be demonstrated experimentally. Secondly, the amount of conscious control that can be exerted in the case of PK is almost nil.<sup>2</sup> This is so even in those exceptional cases of directly observable or macro-PK effects, where objects move or metals bend. Indeed, it may be doubted whether we can rightly speak of "willing" in connection with PK. At most the subject can *wish* for a certain result to come about, but there is not much he can then specifically do to *make* it come about. In the case of RSPK phenomena even the conscious wish may be absent, so that it is only by a process of elimination and inference that we identify a particular individual as the subject or "poltergeist focus." In view of these obvious differences between voluntary movement and PK many would wish to argue that there was nothing to be gained by pressing the analogy and subsuming both under the same rubric.

Nevertheless, in spite of such asymmetries, there are important respects in which the two processes resemble one another. In the first place, they are both goal-oriented or teleological-type processes, in the sense that a given state of affairs is achieved without there being any awareness on anyone's part as to the precise means necessary for such an achievement to be possible. Thus, when I stretch out my hand to pick up an object off the table, I know nothing at all about the sequence of physiological events starting in the motor cortex of my brain and leading up to the contraction of muscle groups in my arm and fingers that must precede any action on my part. But, even with regard to the overt movements which I then proceed to execute, I am largely dependent on a stock of tacit knowledge which never enters my focal awareness. In much the same way, the successful PK subject becomes aware of the results which he produces while remaining totally ignorant of the microprocesses, mechanical or electronic, which must take place in the target system for such results to be possible. In the second place, voluntary movement and PK are intimately

bound up with the provision of feedback. Our muscles are not just effectors but also receptors, so that with every contraction of the muscles there is some proprioceptive feedback and, at least in the case of the manipulatory skills we perform with our fingers, there is usually some visual feedback as well, although touch typing would be an exception. To what extent PK is dependent on the visual or auditory feedback that is usually provided by the experimental set-up is still a matter for speculation, but, for one school of thought, at any rate, that represented by the influential "observational theories" of PK associated with such theorists as Helmut Schmidt and Evans Walker, it is critical. According to these theories, it is not until feedback is received that the train of events leading up to the observed outcome is determined. This implies, paradoxically, a causal loop in time between aiming at a given result and observing its realization. Whether a similar "observational theory" of voluntary movement is conceivable is not a question I shall pursue here, as it would take me too far afield. In the present context I want only to stress that feedback enters into both voluntary movement and PK in this integral way in virtually every instance that we can cite.

I am going to suggest that we may be able to arrive at a better understanding of the connection between voluntary movement and PK if we look at an intermediate class of phenomena which partakes of some of the characteristics of each. It is here I wish to introduce the topic of biofeedback control. We can now demonstrate that people can acquire control over certain physiological functions which, in the ordinary way, are beyond conscious control by adopting certain special techniques. The functions in question are mainly those associated with the autonomic nervous system, heart-rate, vasodilation, glandular secretion etc. but may include functions of the central nervous system such as brain rhythms and measures of arousal. There is one function, rate of breathing, which ordinarily operates automatically, but which can be consciously controlled without using any special technique, but here I shall be concerned only with those where a special training is required. There are a variety of such special techniques, the oldest of which are the systems of yoga, but the one with which I shall be concerned is that known as biofeedback, which is based on allowing the subject to monitor his own physiological output through appropriate visual or auditory displays.

Biofeedback is a normal phenomenon, in the sense that it does not, as far as is known, transcend any limits of what is considered within the natural capacity of the nervous system. Moreover, anyone can acquire a moderate degree of proficiency in biofeedback control; no special ability is presupposed. At the same time, from the psychological point of view, there are important respects in which the phenomenon resembles PK. I am thinking especially of its dependence on what Elmer Green (1976) has called "passive volition." One cannot produce a biofeedback effect, as one might the raising of one's arm, by a simple fiat of the will. Rather, one has to want the effect to come about and

wait hopefully, in a half expectant yet relaxed frame of mind, for it to appear spontaneously. This is notoriously the case with the control of alpha rhythm, for it is one of the paradoxes of the biofeedback technique that alpha rhythm will vanish if the subject makes a conscious effort to produce it! There is a parallel here with the finding that the best scores in a PK test are often obtained when the subject is least trying to produce them. Rex Stanford coined the expression "release of effort" to cover cases in which significant scores are obtained by the subject after the termination of the official run when, unknown to the subject, the target generator is kept going. But others too, have noted that a state of relaxation is conducive to success. Thouless and Wiesner suggested that this might be due to the fact that active volition would have the effect of channeling the influence directed onto the target system back into the subject's own motor system.

Certainly, at a purely formal level, there is a striking similarity between the typical biofeedback set-up and the PK set-up as this has been developed especially by Helmut Schmidt and has since become standard laboratory practice. Of course, objectively, there is a world of difference, depending on whether the feedback display is coupled with the subject's own body, as with biofeedback, or with an electronic random event generator, as with PK, but this does not preclude the possibility that the same basic phenomenon underlies both. And this possibility begins to loom larger when we venture beyond biofeedback studies of the routine kind to consider certain virtuoso performances by those who, in one way or another, have learned to control their own organism. Take, for example, such performers as Swami Rama or Jack Schwarz, to name but two who have both been tested in some depth at the Menninger Institute. Swami Rama has demonstrated differential control over the arteries of his right hand to the extent of producing changes of temperature in opposite directions on two spots of his right palm only a few inches apart amounting to a differential of about 10°F. He has also demonstrated control of his heart beat to the extent of completely arresting the circulation of his blood for as much as 17 seconds, having been dissuaded from prolonging the effect (Green et al., 1976). Jack Schwarz, a Dutch-American who belongs by rights to the Indian fakir tradition, has, for his part, demonstrated feats of self-wounding which not only fail to elicit any pain reaction or even any bleeding but, more surprisingly still, the wound never becomes infected no matter how severe or how soiled the implement used (Rorvik 1976). It is, further, of interest to learn that both Swami Rama and Jack Schwarz are credited with special powers of self-healing of a kind that psychic healers are supposed to be able to exert on an alien body.

But, to return to biofeedback proper, I want next to discuss one particular study which is linked with the problem of voluntary movement and to which Honorton (1976) drew our attention in his presidential address to the Parapsychological Association in 1975. I refer to the electromyographic experiments

of John Basmajian (1972) as reported in *Science*. His experiments consisted of training his subjects to activate specific motor units within certain selected skeletal muscles; he used mainly the forearm, shoulder and neck muscles. His subjects were given both visual and auditory feedback of the varying myoelectric potential in the specific motor unit in question as recorded by means of microelectrodes planted in the muscle fiber. It transpired that any normal volunteer subject could, within a few minutes, learn to control the appropriate unit. From then on he could be taught increasingly difficult discriminations, for example activating one given unit rather than another neighboring unit, varying at will the rate at which it was firing and, finally, being able to control it even in the absence of any exteroceptive feedback. To quote the author: "Some persons can be trained to gain control of isolated motor units to such a degree that, with both visual and aural cues shut off, they can recall any one of three favorite units on command and in any sequence. They can keep such units firing without any conscious awareness other than the assurance (after the fact) that they have succeeded. In spite of considerable introspection they cannot explain their success except to state they thought about a motor unit as though they had seen and heard it personally."

This is an unusual application of the biofeedback technique, inasmuch as the effect involved is not some involuntary autonomic function, but rather a highly specific component of our ordinary voluntary motor activity. Ordinarily, all that we are able to do, voluntarily, is to control the gross movements of our limbs, but, after a Basmajian type training, we can, it seems, turn on or off at will the firing of a single motor unit. We have no idea how we do this any more than we know how we succeed in wagging a given finger. All we know, in both instances, is that, by taking thought, we can bring about the desired effect. The relevance of the Basmajian work for our present purposes is that it shows how, at the microscopic level of analysis, voluntary movement and biofeedback control converge.

I want next to discuss a very different experiment which attempts, rather, to bring together biofeedback control and PK. This is an experiment of William Braud's which he reported at the 1977 P.A. Convention where he introduced his intriguing concept of "allobiofeedback." It is evident that any biofeedback set-up could be converted into a PK set-up by the simple expedient of coupling the feedback display to another person's body in place of the subject's own body. In Braud's experiment he himself acted as subject and his task was alternatively to increase or decrease, according to a random schedule of instructions, the GSR amplitude of a target-person whose GSR tracing he was meanwhile monitoring. The design of the experiment was a very complicated one, inasmuch as the target-persons were themselves acting as subjects with respect to a test involving clairvoyance and relaxation, but these complications need not detain us here. Suffice it to say that the allobiofeedback test was successful in that, out of the ten target-persons involved in the confirmation

experiment, eight produced higher GSR amplitudes during those runs in which Braud was aiming to increase them and that a t-test of the difference between the two conditions was significant at the one percent level of confidence. Discussing his findings, Braud claims that the concept of allobiofeedback is the simplest way of conceptualizing the situation; in other words that what we have here is a feedback loop that is closed by a PK influence directed onto a live target system. As is always the case, however, in a parapsychological experiment, there is enough ambiguity in the situation to permit other interpretations. As he points out, the results could have been due to a telepathic influence that he might have been exerting on the target-person's mind rather than on his body and even more devious interpretations are possible that we need not pursue here.

At all events, before the concept of allobiofeedback becomes established, several pertinent factors call for clarification. First, how critical was the provision of feedback in this instance? Could the subject have influenced the activity of the target-persons had he *not* been monitoring their output? It is noteworthy that, in another experiment by Braud and Braud reported at the same Convention, PK effects on a random event generator were obtained in the absence of feedback. Secondly, is a live target-system such as this a more sensitive detector of PK than an inanimate random event generator? On the Thouless-Wiesner hypothesis that PK is essentially the power we normally use to control our own brain, we should expect this to be the case, since one brain is more like another than it is like an electronic machine.<sup>b</sup> However, since the great majority of PK experiments have been done with artificial target-systems we have little basis for comparison. There may even be a flaw in the argument which would lead us to expect better results from a live target-system since, if we adopt an observational theory of psi, it would make no difference in the last resort what processes were involved in the production of a given PK effect all that counts is the final awareness of the effect that has been produced. Whatever the outcome may be, we must hope that many more allobiofeedback experiments will be forthcoming in the years ahead. It would be of particular interest to take a subject who had first mastered autobiofeedback control and switch him without warning to the allobiofeedback condition. Would there be a carry-over from the normal to the paranormal condition? Would he proceed to control both his own and the target-person's output in unison? Or would conflicting exteroceptive and interoceptive feedback make such a deception impossible, so that the experiment would founder with the subject in a state of total confusion?

Leaving such questions unanswered, let us revert to the familiar case of normal volitional activity. We must start by recognizing that, according to the orthodox view that still prevails alike in science and philosophy, there is, strictly speaking, no such thing as a volition. The distinction between voluntary behavior on the one hand and involuntary, automatic or reflex behavior on

the other, depends on the kind of brain processing that goes on, not on whether such behavior is, or is not, preceded by, or accompanied by, an "act of will," whatever we are to understand by that phrase. For, ultimately, in the orthodox view, it is the brain alone which governs the activity of the limbs. The organism as a whole may be conceived of as a self-regulating cybernetic machine and the interaction of the organism and its environment constitutes a closed physical loop which admits of no extraneous influences and interventions of a nonphysical kind. As for the familiar experience of free will on which we humans set such store, the experience of acting freely according to conscious decisions for which we as persons or selves take sole responsibility, that is no more than a subjective or epiphenomenal reflection of whatever physical brain states are the real causes of our behavior.

One notable brain physiologist of recent times who has never accepted this orthodox view of voluntary movement is Sir John Eccles, who gave the invited address to the P.A. Convention in Utrecht in 1976 (Eccles 1977). Already in his Waynflete lectures in Oxford in 1952 (Eccles 1953), that were later published as *The Neurophysiological Basis of Mind*, he shocked the scientific and philosophical establishment, which were particularly well entrenched at Oxford, by putting forward what he has called his "neurophysiological hypothesis of will." This is based on the observation that the situation at the synapse through which the neural impulse must pass is so delicately poised that factors at the level of quantum uncertainty may decide whether the impulse is discharged or not. In such a situation, a psychic influence might tilt the balance one way or the other since, whether or not there is a ghost in the machine, the brain appears to be just the kind of machine that a ghost might be expected to operate! Furthermore, given the prodigious interconnectedness of our brain cells, even one such intervention might produce an appreciable effect on the overall output of the brain or, as he puts it (Eccles 1970): "within 20 milliseconds the pattern of discharge of even hundreds of thousands of neurones would be modified as the result of an 'influence' that initially caused the discharge of merely one neurone." But there is no need to stop there. The same mind influence could conceivably operate holistically by exerting spatio-temporal "fields of influence" on the cortex, which would be uniquely fitted to respond. It is of some interest to note, in passing, that, more than a century before, the great physiologist, Johannes Müller, had proposed a very similar conception of the will when he declared that: "the fibers of all the motor, cerebral and spinal nerves may be imagined spread out in the medulla oblongata and exposed to the influence of the will like the keys of the piano-forte."

Recently Eccles joined forces with the philosopher Karl Popper and last year the two of them published a large volume entitled *The Self and Its Brain* which bore the subtitle *An Argument for Interactionism* (Popper & Eccles 1977). In his section of this book, Eccles further elaborates, with plentiful

anatomical detail, his ideas about the interaction between what it pleases him to call "the self-conscious mind" and the "liaison brain." The latter, he speculates, consists of complex modules of neurones in columnar formation, each module comprising some 10,000 neurones including many hundreds of pyramidal cells. In his chapter on "Voluntary Movement," Eccles draws attention to the work of H.H. Kornhuber, a German neurophysiologist, which, he claims, illustrates in its purest form the action of mind on brain. Essentially, what Kornhuber did was to get his subject, who had first been carefully trained to maintain a relaxed posture, to wag his right index finger at irregular intervals, entirely of his own volition, when care had been taken to exclude any possible triggering stimulus from the environment. While he was doing this, certain electrical potentials were recorded from various sites on the subject's scalp and these were then averaged over some 250 recordings. The resultant curve revealed a concentration of neuronal activity in the pyramidal cells of the motor cortex occurring at about 1/20th sec. before the muscular response, an interval which, as Eccles points out, is just about adequate for transmission of the impulse from the pyramidal cells down to the muscle fibers in the finger. This, then, provides at least a partial answer to the question of what goes on in the brain when a willed action is in process of being carried out. The more searching question is whether it provides evidence of the action of mind on brain.

Eccles repeatedly insists that it does, although he realizes that the upholders of the orthodox view will be reluctant to admit it. They will argue that, when the subject receives his instructions, the brain, like a computer, stores the information and duly programs the subject to emit the required response at irregular intervals. But Eccles will have none of this. "The stringent conditions of the Kornhuber experiment," he insists, "preclude or negate such explanatory claims. The trained subjects literally do make the movements in the absence of any determining influences from the environment and any random potentials generated by the relaxed brain would be virtually eliminated by the averaging of 250 traces." He concludes, therefore, that: "we can regard these experiments as providing a convincing demonstration that voluntary movements can be freely initiated independently of any determining influences that are entirely within the neuronal machinery of the brain" (1977, p. 294).

I think I need hardly say that not even the authority of an Eccles, nor yet the argumentative skill of a Popper, is likely to make much impact on the committed materialist. It is significant, however, that neither Eccles nor Popper is prepared to avail himself of the parapsychological evidence and bring it to bear on the issue, indeed neither is yet willing to acknowledge the existence of PK. Eccles, at one point, expresses some surprise that the activity of the "self-conscious mind" should be limited to a single individual brain, but he never pauses to consider whether this is indeed always, and necessarily, the case.

Thus, much as I admire these two great men for doing battle on behalf of the autonomy of mind, I consider that their case is weaker than it might be for lack of this crucial prop and that, if, for our part, we can place the evidence for PK on a footing where it can no longer be ignored by official science, we shall succeed in clinching the argument in favor of treating voluntary movement as an expression of free will.

I have tried, in this paper, to show that the assumption that PK is a form of volitional activity directed onto the outside world has implications for the philosophy of mind and, conversely, the dualistic view of the mind-body relationship has implications for the study of PK. However, as I am always being reminded by my more experimentally minded associates, a theory is no use unless its implications are testable and so, in what remains of my time, I want to say a few words about the sort of lines along which such tests might hopefully be conducted, even if I cannot as yet be very explicit. If I am correct in thinking that in PK we use the same basic means to influence the target-system as normally we use to control the brain, then two possibilities suggest themselves. Either we might try preventing the subject from exercising normal voluntary movement hoping that, in desperation, he will be driven to exteriorize his powers in the form of PK or, alternatively, we could arouse the subject's normal volitional activities in such a way that the powers involved will spill over onto the target system. As it happens, support can be found in favor of each of these possibilities in the existing literature. With respect to PK of the microscopic or statistical kind, I have already mentioned the importance of adopting an attitude of passive volition suggesting, perhaps, that PK might here function as a substitute for normal voluntary effort. In that case, it may be worth testing those who either happen to be paralyzed or could be experimentally made so and would thus be physically debarred from control of their limbs, but it might also be worth seeing what happens to a random event generator during the REM stage of sleep when we are all of us paralyzed. However, with respect to PK of the macroscopic or directly observable kind, the evidence suggests that the successful subjects are usually in a state of high arousal. This was specially the case with Nina Kulagina, but even with a physical medium like Rudi Schneider, who was in a complete trance when he produced his phenomena, it was observed that both his breathing and heart rate underwent an astonishing acceleration. If this "spill-over" model of PK should prove more appropriate in certain circumstances we would have to find ways of arousing the subject.

While I was still engaged in speculating on these possibilities for research, I was happy to learn that Charles Honorton had been thinking along rather similar lines and had, indeed, already carried out some pioneering work in this connection which had yielded positive results. His particular strategy (as described in a paper he is presenting at this conference; Parapsychology Foundation 1979) was to use biofeedback in order to train his subjects to control

their alpha rhythm. A random event generator is then brought into play and the experimenter finds out whether its output is significantly biased from the random baseline during the critical phases when control of the alpha rhythm is achieved. Honorton's experiments, which have already provided some promising data, are based on a rationale that is somewhat different from either the substitution model or the spill-over model that I discussed earlier. Presumably like me, Honorton was impressed with the similarities he had observed as between the biofeedback situation and the PK situation and took this as his point of departure. But, be that as it may, he has added a further impetus towards searching for a common thread uniting the phenomena of voluntary movement, biofeedback control and PK.

## Notes

a. In the course of the subsequent discussion, Tart pointed out that one of the reasons for this difference is that normal voluntary movement has obvious survival value and is practiced intensively from the cradle onwards whereas, in the case of PK, the whole ethos of our culture is against trying to foster it. Tart may well be right but, to clinch the argument, we would need the example of at least one society where PK was successfully inculcated.

b. William Braud has coined the expression "bio-PK" for the case where PK is exerted on living organisms. One can say that most of the research he has carried out since he moved to the Mind Science Foundation in San Antonio, Texas, has been concerned with the bio-PK effect (see Braud and Schlitz 1983). The allobiofeedback experiment can be seen as a special instance of bio-PK and it has obvious implications for the question of paranormal healing. As an example of their latest work, see "A Methodology for the Objective Study of Transpersonal Imagery" by William Braud and Marilyn Schlitz, *Journal of Scientific Exploration*, 1989, 43-63.